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A New Method of Bronchoscopy with Cinematography and Still Photography

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A NEW French apparatus now permits an endobronchoscopic film to be produced in the course of each bronchoscopy. An objective record of the specialist's examination may thus be kept, a document which may be studied or discussed in the interest of the patient.

It would not occur to a radiologist to be content with a fluoroscopic examination when he detects a pathological condition of the lungs. The endoscopist, likewise, has felt for many years that his reported observations, often recorded in considerable haste and illustrated with a diagram, represents records which are still very incomplete (even when such a diagram is drawn with the greatest skill and accuracy).

Holinger[1,2,3], of Chicago, should be credited with having produced the first endobronchoscopic films. His films are known not only in America but throughout the world as well. With his photographic equipment, endobronchoscopic 16 mm. color films of rare quality may be made at 16 or 24 frames per second. In France, Dr. André Soulas has used similar equipment, obtained in Chicago nearly ten years ago, to produce the first European endobronchoscopic films[4,5].

As a result of improvements recently achieved with a new bronchoscope, developed by Fourestier, Gladu and Vulmière, documentation may now be obtained through post-telescopic cinematography, at 16 frames per second, utilizing 8 mm. and 16 mm. films[7,8].

The apparatus (Fig. 1) is of standard diameter and is easily handled. For this reason we have been able to do systematic cinematography in our service since June, 1954. Every bronchoscopic examination thus becomes suitable for photography, yielding a valuable record, which may later be studied at leisure, compared with the rest of the patient's record, and which gives, moreover, a faithful reproduction of the bronchi, whether normal or pathological. This method is utilized in several Paris hospitals and especially in the Laënnec Hospital (Prof. E. Bernard) and in several province hospitals, particularly in the Reims hospital.

The bronchologist very quickly discovers the techniques which allow him to obtain excellent films. When the operator and personnel are accustomed to the technique, filming the examination requires no more time than a normal bronchoscopy and provides better illumination.

The life-like character of the endobronchoscopic pictures is particularly interesting to note. The normal movements of the bronchi are of several orders: inspiratory enlargement of the caliber of

the bronchi; ascending expiratory movements of the whole bronchial tree; transmission of heart beats; suppleness of the mucous membrane; important changes observed in asthma, cancer, etc.; and experimental studies in animals can be easily followed.

The head of a large hospital service can now be informed of the state of a patient's bronchi in a way that was formerly possible only for the bronchoscopist. The same is true for assistants and students. The educational nature of these photographic records cannot be stressed too strongly.

Figure 1. Endoscope and accessory table (after Fourestier, Gladu and Vulmière).

At the time of the medical-surgical conference, in an era when pulmonary or bronchial resection is essentially conservative, it is particularly important for the bronchoscopist or surgeon to have information which will be useful at the time of the intervention.

Systematic endobronchoscopic cinematography will henceforth permit each patient to have documented observations which are actually complete. It is easy for the bronchologist to have a small projection room near his office where a projector is permanently installed. It takes no longer to run a film than to view a series of tomograms on an x-ray viewer. Such an endobronchoscopic document can have considerable interest, not for the bronchologists themselves, but also at the time of presentation of their work in the professional societies when bronchial lesions can be shown as well as discussed.

MATERIALS

It was necessary to find a simple means, available to every practitioner, to combine in a simple operation classical bronchoscopy and photography, just as it is possible to pass in a few seconds from fluoroscopy to radiography through the simple adjustment of a cassette.

Today, the problem is solved and we have an apparatus utilizing bronchoscopic tubes of standard diameter, standard telescopes through which the pictures are taken, and possessing an illumination 200 times more powerful than usual. This permits photographic or cinematographic recording to be made instantaneously, with the simple aid of a photographic

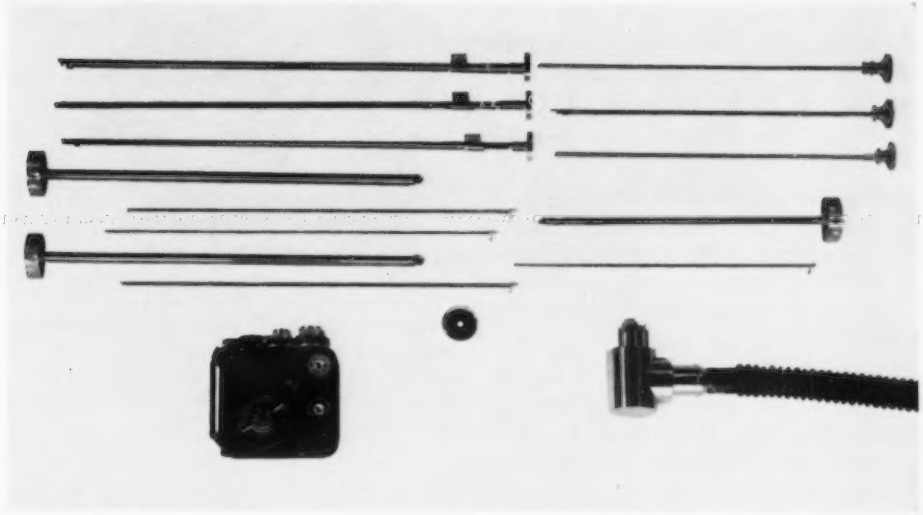

Figure 2. Bronchoscope components: *Left:* 3 telescopes (1 direct, 2 right-angle), bronchoscopic tube, 2 direct quartz rods, bronchoscopic tube, lateral quartz rod — for adults. *Right:* 3 telescopes, bronchoscopic tube, quartz rod — for children. *Below:* cinematographic camera, adapter, illuminator.

apparatus, or with any commercial camera desired, placed against the eye piece of the telescope.

This apparatus [6,9] is composed of several parts (Fig. 2), as follows:

Bronchoscope

The bronchoscopic tubes present few modifications in relation to those of classical instrumentation. The diameter and the length of the tube for an adult are exactly the same as those of the tube currently in use, 8 mm. diameter by 40 cm. long. The thickness of its wall is 0.5 mm.[10].

The classical light carrying canal, into which a quartz rod is introduced, is soldered to the interior of the principal tube. Thus the bronchoscope may be rotated in the bronchus without trauma. The light carrier canal has a diameter of 3 mm. and a wall 0.1 mm. in thickness. The interior of the tube is coated with an electrolytic deposit of black nickel which is flat and non-reflecting.

The tubes must be constructed of an alloy with a nickel base, instead of brass, in such a way as to be perfectly rigid in order to avoid breaking the quartz rod in the course of bronchoscopic maneuvers. They thus have a much greater resistance to bending. It is desirable to have a tube which does not bend if the larynx is anterior or the neck short.

The distal extremity of the tube is bevelled, but at its proximal extremity a plate, 50 mm. in diameter, permits the illuminator, Galileo magnifier, or proximal telescope to be adjusted or removed rapidly by means of pegs. We now have tubes for children, based on analogous principles.

Illumination System

The method of illumination constitutes the true originality of the system. Until

recently, in France, a distal light source has been used. The illumination given by this small bulb (a masterpiece of manufacturing), nevertheless, is not comparable to that obtained with the new apparatus.

Now a proximal light source is used, the size and power of which is limited only by optical considerations. The image of the filament is transmitted to the distal end of the scope by a transparent rod of fused silicon (quartz rod).

The *light source* (Figs. 3, 4) is composed of a standard high intensity, low voltage microscope lamp (6 or 8 volts, 5 amperes, 2 mm. filament). This is placed in a metal case of a size which permits ease in manipulation. The lamp housing is a cylinder 90 mm. long and 50 mm. in diameter. Its weight is about 650 gms. It is cooled by aspirated air.

The filament is centered in the housing in such a manner that it is at the optical center of a concave mirror. The direct and reflected light is then picked up by a condenser composed of two plano-convex aspheric lenses. The beam is then directed at a 90° angle, by a prism, through the exit of the housing, a small orific 3 mm. in diameter. This orifice is in close approximation with the proximal end of the quartz rod. When

Figure 3. Illuminator (opened to show bulb.)

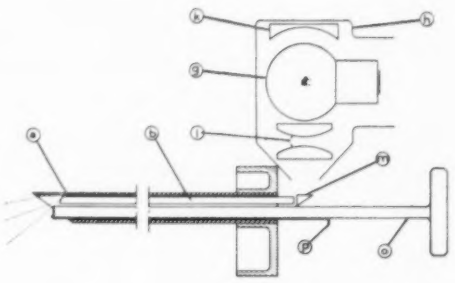

Figure 4. Simplified diagram of bronchoscope and illuminator. *a*, bronchoscopic tube; *b*, quartz rod; *g*, bulb; *h*, illuminator housing; *k*, concave mirror; *l*, lenses; *m*, prism; *o*, telescope.

the lamp is illuminated, a special viewer permits accurate centering of the filament; the centering can be adjusted with the aid of three screws acting upon the bulb support.

The lamp housing is cooled by drawing air through the housing. Air enters through 24 small holes, placed on the bottom of the housing, and is drawn through a large tube on the side of the housing connected to an aspirator. The aspirator tube also contains electric wires for the lamp and a small tube for supplying compressed air for the anti-fogging system of the telescope. This large flexible tube leads to the aspirator, compressor, transformer and voltmeter (Fig. 5).

The lamp housing is attached to the plate of the bronchoscopic tube by three pegs which assures solidarity and optical alignment of the whole apparatus. One of the pegs also serves as a connector to conduct the compressed air for the anti-fogging system of the telescope.

The *quartz rod* has a diameter of 2.5 mm. and a length of 410 mm. It is partially encased in silver and copper, surrounded by a protecting envelope of nickel. Its two extremities are smooth.

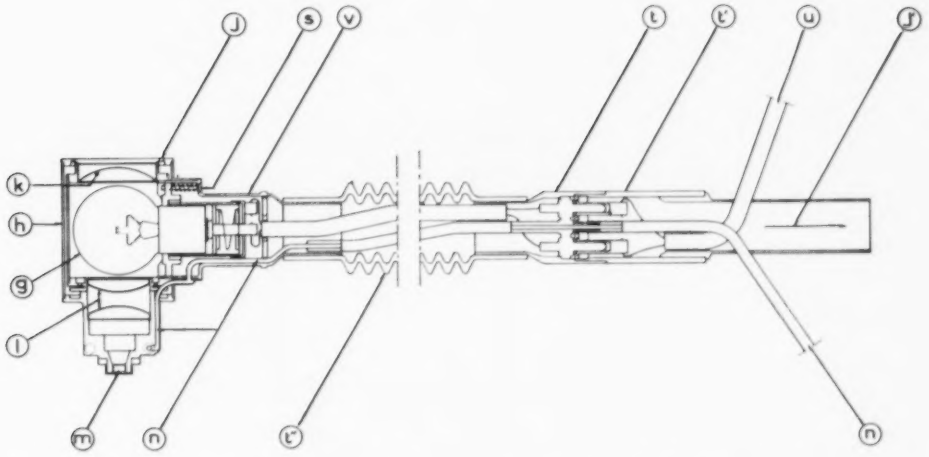

Figure 5. Section through illuminator and connector tube. *g*, bulb; *h*, illuminator housing; *j*, ventilation hole; *j'*, aspirator tube; *k*, concave mirror; *l*, plano-convex lenses; *m*, prism; *n*, air tube for anti-fogging system; *s*, bulb centering screw; *u*, wires to bulb.

The proximal end is cut at a right angle; the distal end has a form which varies with the direction one wishes to give the luminous tract. The rod is either bevelled to send the ray solely into the field of the direct telescope, or terminates in a mirror which permits reflection of light in an oblique direction to light the fields of the lateral telescopes. In either case, the rod transmits at its distal end 80% of the light input.

Telescopes

Direct and lateral vision telescopes adapted to the Wolde bronchoscope and provided with an anti-vapor system, the importance of which is paramount in the success of photography. The telescopes (Figs. 6, 7) are of standard construction using the best coated lenses available. However, along the length of the telescope, and in its metal casing, a very fine tube is incorporated, the anti-fogging system, which will conduct air. The air pressure for this purpose is carried through the small tube, within the large flexible tube described above, and passes through one of the pegs which helps to keep the telescope in place. This is important, because the distal extremity of the telescope must be fixed in relation to the distal extremity of the quartz rod. After travelling the length of the telescope, the air is blown across the distal lens surface, thus eliminating fogging. This avoids the use of anti-vapor liquids which may distort the photographic image.

The direct telescope is the most commonly used. However, to obtain good records, it may be necessary to resort to various telescopes whose sighting axes vary from 30° to 120° from the axis of the direct telescope (Fig. 8).

The special quartz rods for lateral lighting are indispensable. It is easy, in the course of bronchoscopy, to change the quartz rods in order to have the one which suits the field of the telescope being used.

The apparatus which has just been described must be specially made and cer-

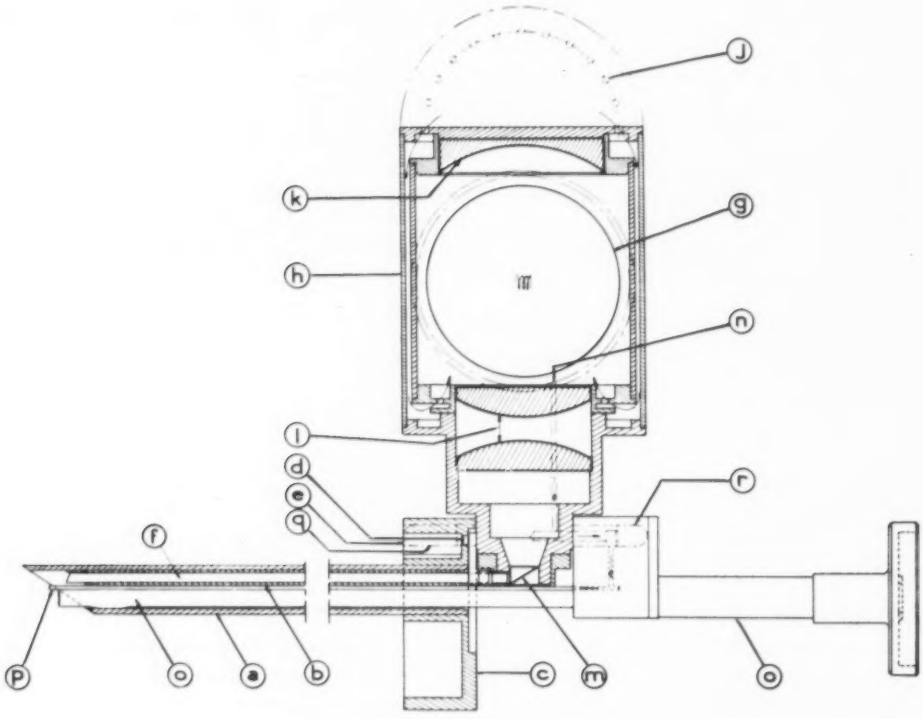

Figure 6. Section through bronchoscope and illuminator (for direct illumination). *a*, bronchoscopic tube; *b*, light-carrier canal; *f*, quartz rod; *g*, bulb; *h*, illuminator housing; *j*, ventilation holes; *k*, concave mirror; *l*, plano-convex lenses; *m*, prism; *n*, air tube for anti-fogging system; *o*, telescope; *p*, orifice of anti-fogging system.

tain of the parts have been patented by the National Center of Scientific Research (France). The material to be described next is in current use, only their assembly is original. We shall consider these accessories and their mode of attachment to the bronchoscope.

Accessory Equipment

Transformer: Furnished with a voltmeter and regulator adaptable for 110 or 220 volts, supplies a secondary voltage of 4-12 volts. During visual bronchoscopy 4-5 volts is used. During photography it is necessary to increase the voltage to 10-11 volts. A hand or pedal rheostat makes it possible to change from one voltage range to the other:

Aspirator: For drawing cooling air through the lamp housing; is 1/4 horse power.

Compressor: Used for the anti-fogging flow of air; is low power.

These three parts of the apparatus may be placed together on an instrument table, or incorporated into a carrying case. In either case, a metal tube will permit the electric wires and air tubes to be grouped together and also serve as a support for the bronchoscope. A flexible tube, about 1 meter in length, connects

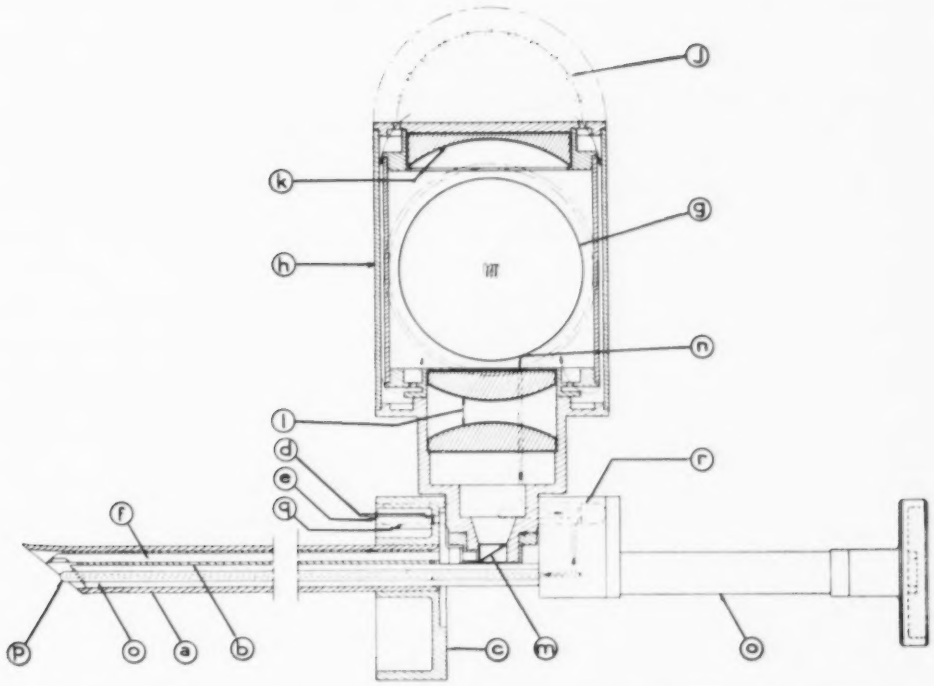

Figure 7. Section through bronchoscope and illuminator (for right-angle illumination). *a*, bronchoscopic tube; *b*, light-carrier canal; *f*, quartz rod; *g*, bulb; *h*, illuminator housing; *k*, concave mirror; *l*, plano-convex lenses; *m*, prism; *o*, telescope; *p*, orifice of anti-fogging system.

the metal supporting tube to the lamp housing.

Photographic Equipment

Cinematography: An 8 mm. camera, equipped with a 12.5 mm., f/1.9 lens, is used at 16 frames per second[7]. A 16 mm. camera, equipped with 17 or 20 mm., f/1.5 lens, at 16 frames per second may also be used[5]. With either camera the focus setting is 0.50 m. If an infinity setting is used, a supplementary lens becomes necessary.

Still Photography: Should consist of a 35 mm. reflex camera equipped with a 35-38 mm., f/3.4 lens. The focus setting should be 0.50-0.60 m.

The photographic apparatus is used by close alignment of the camera lens to the eye piece of the telescope. A small adaptor on the camera lens will insure proper alignment. This adaptor should contain an additional lens for use with a camera that cannot be focused directly.

Optional Accessories

Galileo Magnifier: This proximal telescope may be adapted to the bronchoscope instead of the usual bronchoscopic telescope. It simplifies bronchoscopic maneuvering by magnifying the image three times. It may be used during the introduction of the tube, examination of the bronchi, or for obtaining specimens for laboratory examination.

View-finder with two telescopes: Com-

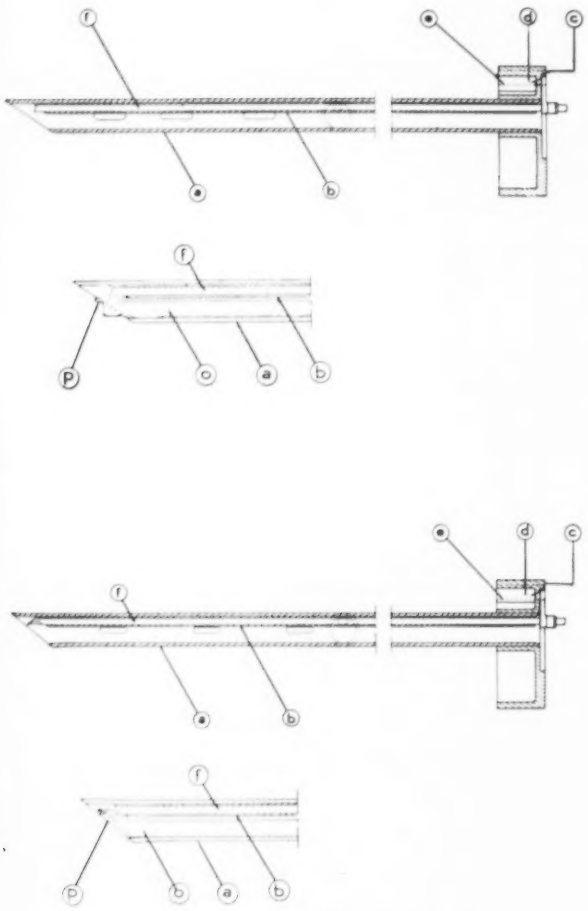

Figure 8. Section through bronchoscope. *a*, bronchoscopic tube; *b*, light-carrier canal; *f*, quartz rod; *o*, telescope (direct or right-angle).

posed of two Galileo view-finders, with a beam splitter, permitting two simultaneous observations. It permits two to observe the progress of bronchoscopy and is, therefore, of great didactic value.

METHODS

We request our patients to fast the morning of the examination. The night before, on retiring, and upon awakening in the morning a barbiturate is prescribed. One half hour before the examination ½ or 1 mg. of Atropine is administered sub-cutaneously. We never employ premedication with an opiate base and only exceptionally give a curari derivative. A local anesthesic, 5-10 cc. of 1% tetracaine (or pentocaine), is given in classical fashion with a spray and laryngeal syringe.

At the time of bronchoscopy the bronchoscopic tube, with Jackson's light carrier, may be passed through the pharynx and larynx. We prefer to use the quartz rod lighting system during the introduction of the scope. While there is some risk of breaking the quartz rod, if the introduction is difficult, this incident has seemed exceptional to us. It is important that secretions not be permitted to collect on the distal end of the bronchoscope. If they are deposited on the extremity of the rod they are difficult to remove and prevent good light transmission. Likewise, we always check, before proceeding into the trachea or bronchi with the tube, to see that there are no secretions present in the bronchi. It is necessary to aspirate them before the extremity of the rod or telescope becomes soiled. The success of photography depends on small details of this kind.

Subsequent progress into the two sides of the bronchial tree is easily made. The direct telescope permits a field to be seen which is quite extensive in length and depth. It is frequently possible to descend into the terminal branches of the inferior lobe. During the course of bronchial observation it is very easy to alternate the camera and the eye. It is also easy, even without a view-finder, to obtain very good continuous photographs as the scope is advanced or withdrawn to obtain the best information on the character of the bronchial mucous membrane.

Examination of the lateral orifices is made by changing the quartz rods and telescopes.

All the common endobronchic maneuvers are possible with this bronchoscope. They are performed comfortably under intense illumination, which is particularly desirable if there are abundant or bloody secretions. Photographic bronchoscopy does not require more time than ordinary bronchoscopy.

Cinematographic films (Fig. 9) — 8 mm. Kodachrome "A", at 16 frames per second, is used since black and white films lack interest. The quality of the film obtained is really excellent in both clarity of the image and color. Furthermore, details which were unsuspected during the bronchoscopic examination often appear. The bronchoscopy is really completed by cinematographic study of the film on the screen. For each patient, according to the importance of the examination, one to four meters of film are taken. We believe that a film of the whole bronchial tree should be made systematically during all routine bronchoscopy. Normally, however, the taking of the film should not prolong the examination. On the contrary the film permits it to be shortened, since the operator knows that he can review any particular region at his leisure when the film is later projected. The 8 mm. film can be enlarged to 16 mm. for projection in large rooms. This also permits the original to be kept intact. The direct use of 16 mm. films is possible; it is intended, however, that they be used only for teaching or scientific publications. Color slides and prints may be made from individual 8 or 16 mm. frames.

Figure 9. Bronchoscopy with color cinematography 8 mm. camera.

Still Photography (Fig. 10) — Color photographs may be made with 35 mm Ektachrome film with an exposure time of 1/10 to 1/20 of a second, and also Kodachrome "A" at 1/4 to 1/10 of a second. Since processing time is approximately the same as for color cinematographic films, we make them only in exceptional cases. We find that cinematographic films are ultimately more economical and more interesting.

Black and white photographs have the advantage of rapid development. They complete the filmed sequence. Ordinarily we have the print a few hours after the examination. Kodak Plus-X film may be used with an exposure time of 1/25 to 1/40 of a second (Plate 1, 1; Plate 2, 13 and 16). The grain is fine and the exposure time remains sufficiently short.

The photographs shown in this paper (Plates 1 and 2) have not been retouched and were made by a photographer who has not specialized in medical photography. We believe that the technique will

Figure 10. Bronchoscopy with still photography (35 mm. reflex camera).

be improved when more powerful illumination is achieved.

DISCUSSION

The same principle as that previously described for bronchoscopy is applied to the whole field of endoscopy. Esophagoscopy, rectoscopy, cystoscopy, laparoscopy, peritoneoscopy and gastroscopy can be performed with the same kind of apparatus. A modification of the apparatus was designed for the examination of organs which allow the use of a larger tube, such as the rectum, the esophagus, and the stomach[10]. Two light sources and two quartz rods are used (Fig. 11). With a slight increase in the diameter of the tube the lighting of the field of examination may be doubled.

We have recently published a special technic of esophagoscopy with Segal. A cover tube made of transparent plastic was introduced first. This is put into place in the patient, with the help of a mandril, while he is sitting; the technic being the same as that used for introduction of a stomach tube. The patient is then put in the position of esophagoscopy. The mandril is removed and the esophagoscope can be introduced into the cover tube with security; this also avoids soiling the extremity of the tube as it passes through the mouth and throat. It is important that the cover tube be transparent as it allows the opening of the esophagus and the mucous membranes of this region to be inspected as the instrument proceeds. This tube, shorter than the esophagoscope, does not impede the normal handling of the latter. This procedure also allows introduction into the stomach of a rigid gastroscope. The gastroscope can also be used without difficulty for photography.

Recent experience has shown the advantages that can be derived from the use of television. Television can be used in the very room where endoscopy is being performed and a television camera can be adapted in the place of the eye or a film camera. This allows every one present in the room to follow the progress of the apparatus in the organ explored. Moreover, the image which the endoscopist and his assistants see can be watched in the class room of a medical school.

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Figure 11. Esophagoscope showing mandril, transparent plastic cover tube, esophageal tube and double illuminator.

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Publication Data

Plate 1

NORMAL BRONCHI

Carina

1. Tracheo-bronchial spur.

Upper Lobe Orifices

2. Right upper lobe orifice viewed through the right angle telescope.

   The apical branch is reduced to a slit visible at 3 o'clock. For better examination it is necessary to use a right-angle telescope. The anterior orifice is visible at the top, the posterior in the middle, of the field.

3. Left upper lobe spur.

   The lingular division is clearly visible through the right-angle telescope. Its dividing branches may be perceived at the bottom.

Middle Lobe Orifice

4. Middle lobe orifice, viewed through the direct telescope.

   The middle lobe orifice is at 12 o'clock. Secretion is perceptible at the entrance. The orifice of the inferior lobe is below.

5. Orifice of the middle lobe, viewed through the right-angle telescope.

   The departure of the lower lobe bronchus may be detected at 6 o'clock.

Lower Lobe Orifices

6. Bronchi of the right lower lobe, viewed through the direct telescope.

   The medial basal is clearly evident at 9 o'clock. The superior orifice, with bubbling in evidence, is at 5 o'clock. The continuation of the lower lobe bronchus, where spurs of division are perceptible, is at 3 o'clock.

7. Right lower lobe bronchi.

   At 5 o'clock the superior orifice is very open. The first spur of the division is seen. At 11 o'clock is the departure of the medial basal. At 2 o'clock is the termination with three branches: anterior basal, lateral basal, posterior basal.

8. "Terminal bouquet" (same patient as 7; a little deeper).

   From the center toward 3 o'clock: posterior basal, lateral basal, anterior basal.

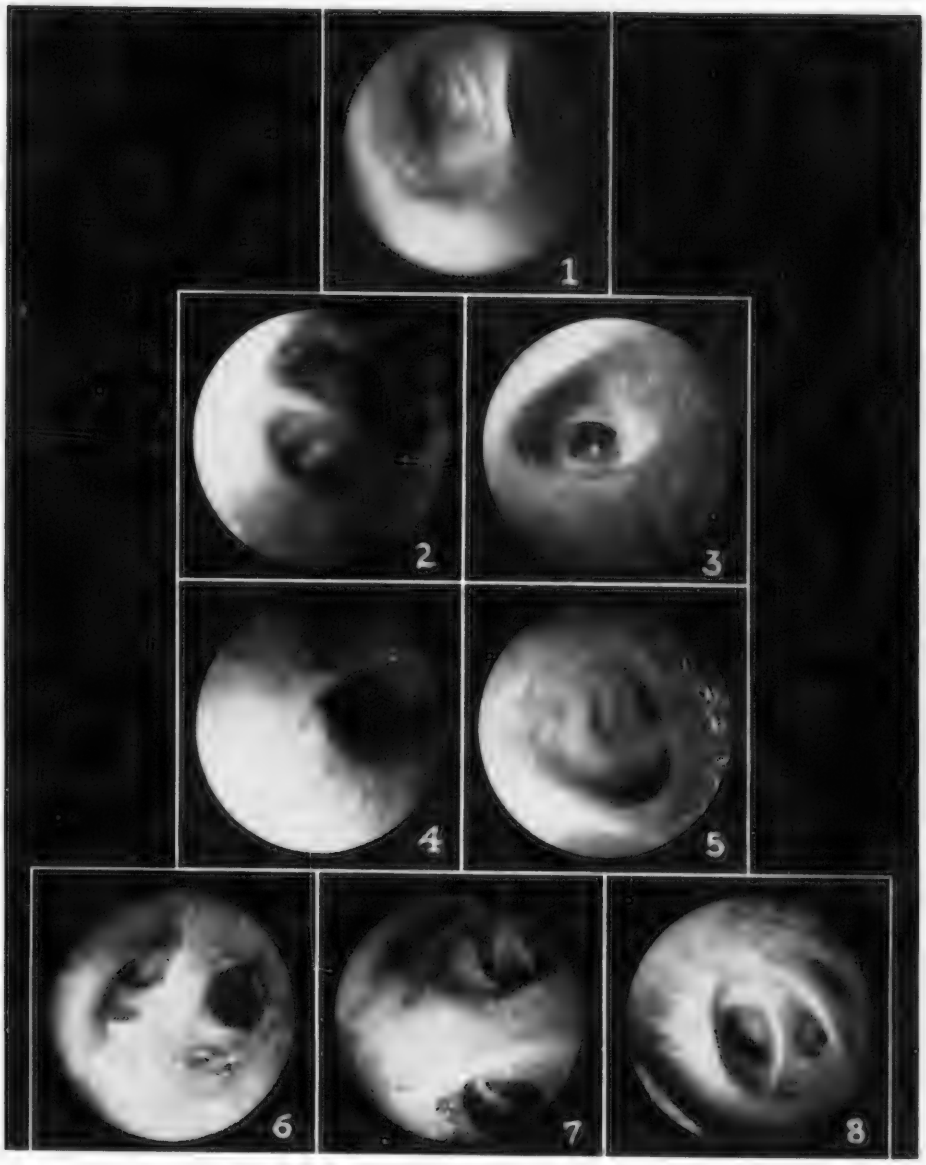
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Plate 2

PATHOLOGICAL BRONCHI

Inflammation

9. Bronchi of the right lower lobe.

At 5 o'clock is the orifice of the superior branch. Toward 12 o'clock is the medial basal. Between the two is the "terminal bouquet". A certain inflammatory and edematous aspect is to be noted. The terminal branch is partially obliterated by abnormal secretion. (The left side is shown in *10*.

10. General view of the bronchi of the lower lobe.

At 11 o'clock is the left upper lobe bronchus orifice. Toward 6 o'clock is the superior orifice. Between the two is the left "terminal bouquet", the classical axis of which is observed: symmetrical from the right, from outside to inside and from front to back. Inflammatory aspect with purulent secretions from the terminal branches. Bronchial dilation.

11. Details of the left lower lobe bronchi (same patient as *10*).

The superior orifice is open widely showing termination in three branches with purulent secretions from the lateral basal.

12. Inflammatory stenosis of the left lower lobe bronchus.

At 10 o'clock is the very patent upper orifice and lingula. The lower lobe orifice, at about 6 o'clock, is almost entirely stenosed. (Before application of adrenalin.)

13. Same patient as *12*, after local application of adrenalin.

Stenosis has been partially relieved.

Asthma — Clearly show the expiratory spasms.

14. Left lower lobe bronchus, during inspiration.

15. Same as *14*, during expiration.

The considerable reduction of the caliber with the exuding of bronchial hypersecretions may be seen.

Bronchial Cancer

16. Aspect currently encountered in a patient with bronchial cancer.

At 12 o'clock is the right middle lobe bronchus orifice. At 4 o'clock is the right lower lobe bronchus orifice from which bloody bubbles are escaping. (Before aspiration.)

17. Same as *16*, after aspiration.

A tumor formation, of whitish appearance, can be observed at the entrance of the right lower lobe bronchus almost completely obliterating it.

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Practical Applications of the Light Meter*

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In 1953 General Electric published a Photo Data book in which a complete description was given of the use of G.E. meters for calculating exposures in close-up photography. Recently the Weston meter manufacturers[2] also published literature describing this method for use with the Weston meter and in the February 1955 issue of this journal[3] there appeared an article by Margery P. Mann on this procedure of calculating exposures for close-up photography. All three of these methods are similar and, if used properly, will render excellent results for routine close-up photography.

Using this as a basis for calculating bellows extension the author has found that, with the addition of a few extra steps, the use of the hand meter can be extended to photomicrography, electronic flash with modeling lights and other setups, as follows:

1. Color Photomicrography with the *Weston Meter*

It should be understood that this method for correlating exposures for photomicrography does not take the place of higher-priced electronic meters. Its sole purpose is to aid those not having the more expensive equipment required for those instances where light is too brilliant through, or where it is not practical to record light at the film plane.

1. The Weston meter is used to measure the light coming through the object and microscope optical system, by holding the meter about an inch above the eye piece and raising or lowering the meter until the highest reading is obtained. This reading is taken through a clear area of the slide, making sure that the area through which light passes includes slide, balsam, and cover slip.

2. The bellows extension is measured in inches, and the f stop scale of the meter dial is used to indicate this measurement. For example, if the bellows extension measures 20 inches, F/20 on the scale is used to represent this reading.

3. Assign a predetermined film speed of 64 to *Ektachrome Type B* film. (This speed is determined by making preliminary test exposures, with the film, bellows extension, and light constant, varying only the time of exposure.)

4. The arrow of the meter dial is moved to coincide with the highest light value obtained in step 1 and the exposure read opposite the f stop corresponding to the bellows extension measured in step 2.

Example:

1. Predetermined film speed for *Ektachrome Type B* film was 64.
2. Highest light value over eye-piece was 25.
3. Bellows extension of apparatus measured 20 inches, or F/20.
4. With film speed set at 64 (Figure 1) and arrow of meter dial set at 25 light value the figure coinciding with F/20 (20 inch bellows extension) is 1 second. This is the correct exposure to use. This method has proven very successful in our laboratory.

Figure 1. Weston meter dial showing example of how exposure for color photomicrography is obtained. The f/scale on the dial represents bellows extension.

*Presented at the 25th Annual Meeting, Milwaukee, Wisconsin, September, 1955. Received for publication September 7, 19

With this method there may be slight film speed variations depending on photomicrography apparatus, and differences in processing procedures and projectors. Higher film speeds may be assigned to black and white films, depending on the filters and emulsion used.

II. Computing Exposures for Electronic Flash with Modeling Lights

The Weston meter was used effectively to compute exposures for electronic flash quickly and accurately. A chart was made, based on a known focal length lens and a predetermined film speed for Ektachrome Daylight type film. This chart contains three factors, the light value, lens to film distance and F/stop as follows:

1. The light reading is obtained, using a Weston meter, by placing a white card at the subject plane to achieve a higher and more accurate reading from the 100 watt modeling lights. Average light values generally range from 13 to 25.
2. The lens to film distance is measured in inches.
3. The correct F/stop to use is found on the chart at the point at which light value reading and lens to film distance intersect. (Figure 2.)

[illegible] using 3 *Ascor* speed lights, 800 watt seconds per light and a flash duration of 1/2000 of a second, was made as follows:

1. The flash duration of 1/2000 of a second was represented by 1 second shutter speed on the meter exposure dial (1 second was chosen arbitrarily because the meter range of shutter speeds does not go as high as 1/2000 of a second)
2. Light reading from white card at subject plane was 13
3. Lens to film distance measured 18 inches from a 10 inch focal length lens
4. Film speed was determined by making preliminary test exposures, keeping the light value (13) and lens to film distance (18 inches) constant, varying only the film speed and F/stop, until proper exposure was obtained. With our equipment the correct film speed is 24.
5. The F/value for the infinity setting is obtained as follows: (Figure 3a)
   a. Set film speed at 24 (from step 4) on exposure control dial
   b. Place arrow of exposure control dial opposite 13 (the light value found in step 2)
   c. Read opposite 1 second (from step 1) to find [illegible] which, in this instance, is f/20

EXPOSURE GUIDE FOR SPEEDLIGHTS USING 10 INCH LENS

LIGHT VALUES	LENS TO FILM DISTANCE								
	10	12	14	16	18	20	22	24	26
	F/STOPS								
8	50	40							
	60	50	45						
1.6	70	56	50	45					
	80	70	63	56	50	40			
3.2	100	80	70	63	56	50	45		
	120	100	80	70	63	60	56	50	45
6.5	140	110	100	90	80	70	63	56	50
	170	140	110	100	90	80	70	63	60
13.0	200	160	140	127	110	100	90	80	70
	240	190	170	150	140	127	110	100	90
25.0	290	220	200	180	160	140	127	110	100
	350	260	250	220	190	170	150	140	127
50.0	420	320	290	250	220	200	180	160	150

NB LIGHT READING WITH WHITE CARD FILM EKTACHROME DAYLIGHT
3 800 WATT SECONDS ASCOR SPEEDLIGHTS

Figure 2

Figure 3. Computing exposure for electronic flash with modeling lights. *a*, Correct infinity f/value; *b*, Lens to film distance computed from infinity f/value; *c*, Correct f/stop is always found opposite 1 second, which represents flash duration of 1/2000 of a second.

6. The correct F/value is now computed from the infinity F/value, taking into consideration the lens to film distance. (Figure 3b) Set F/10 (or 10 inches, the lens focal length) over 1 second (from step 1). Opposite f/18 (or 18 inches lens to film distance) is found 3 seconds, a temporary speed to be used in final step.
7. The infinity F/value, f/20 (from step 5), is now rotated on meter dial to align with 3 seconds (from step 6). (Figure 3c) The F/value opposite 1 second (from step 1) is found to be F/11. This is the correct F/stop to be used for final exposure.

Once the chart is made the correct exposure can be obtained in a matter of seconds. It is felt that with this chart a greater degree of flexibility of light placement can be had for routine lighting, cross lighting, feathering of one or more lights and other special set ups that present an exposure problem.

Black-and-white materials can also be used with this system. Exposure is first computed for color, and iris diaphram is then stopped down to compensate for film speed differences of color and black-and-white material used thus eliminating additional charts.

The main purpose of these two methods is to compute exposures quickly, still retaining uniformity and accuracy.

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2. "Computing Exposure in Close-up Work", Weston Instruction Book, Master II, Model 735 Universal Exposure Meter, page 10.

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A Variable Output Electronic Point Light Source for Photomicrography*

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FROM its earliest inception, which dates back to the days of the daguerreotype, photomicrography was a means of releasing the microscopist from the arduous task of drawing the fields he studied. This applied to fixed and stained preparations only and left the living and highly motile organisms, or particle suspensions, to the visual stamina of the investigator.

As the optical quality of the microscope improved and the photographic process became simplified, investigators again turned to the task of recording living organisms. To do this they resorted to extremely powerful light sources, which were often injurious to living specimens due to their spectral and thermal characteristics. Mechanical means for controlling the exposure to obtain stop-action photographs were used, but the results thus obtained created a demand for shorter and shorter exposures until the mechanical methods were no longer practical. In recent years, the development of phase contrast optics has provided the researcher with a convenient means of observing detail in living organisms. However, in photomicrography these optics, particularly at high power, introduced additional demands on the conventional light sources.

The advent of the electronic flash has not only opened up new frontiers in general and close-up photography, but this light source with its unique and desirable characteristics makes possible new fields in photomicrography.

Four previous techniques for adapting electronic flash sources to photomicrography have been published since 1952.[1-4] In two of these arrangements the flash tube was a spiral which was mounted directly beneath the condenser of the microscope. One was adapted only for a specific microscope, using a built-in light source, and thus was not readily adaptable to other microscopes. None of these techniques fulfilled the requirements outlined below.

An electronic flash for photomicrography should approach a point source of sufficient intensity to make possible the use of the highest power optics for phase contrast and bright field, with either black and white or color emulsions, and of short enough duration to arrest any motion taking place in the field, either Brownian or free swimming organisms. Further, it should have a variable light output, compatible with the various magnifications to be used, and a means of centering the flash and observing the field up to the moment of exposure.

The following is a description of an electronic microscope illuminator fulfill-

*This research was carried out under the auspices of the United States Atomic Energy Commission.

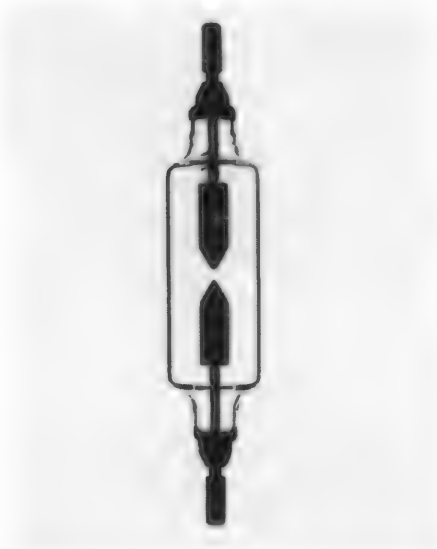

Figure 1. The G.E. FT-230 flash tube showing its small discharge gap

ing all of the aforementioned requirements. One of the important features of the unit is the General Electric FT 230 flashlamp. This lamp, unlike the conventional spiral tubes used in general photography, has a small discharge gap which approaches in size the incandescent sources commonly employed in microscopy (Fig. 1). This small flash gap makes possible the use of a standard microscope lamp housing and condenser and, also, simplifies centering because the electrodes may be imaged and focused in the proper plane by means of a filament lamp incorporated in the housing for observation and focusing.

Operationally the system is one which will give a light pulse having a duration of from 10 to 80 microseconds, depending on which of the three capacitors is discharged through the lamp. The flash

Figure 2. Panel of the charging unit showing the arrangement of controls.

discharge energy is continuously variable over a range of 6 to 200 joules causing the light output to vary correspondingly. Flashes may be repeated at intervals of one minute or less. The interval is determined by the power dissipation (i.e., one 200 joule flash or two 100 joule flashes per minute). Photographs were made at 5 second intervals with the selector switch set at 2 microfarads. The circuit constants of the charging unit have been so chosen that the user need not worry about the limiting dissipation.

In addition to the continuously variable charging circuit the power supply unit has a safety circuit and two charge indicator circuits. An 0 to 2.5 kilovolt meter on the panel (Fig. 2) indicates the voltage to which a condenser is charged. An audible tone is incorporated into the system to enable the microscopist to continuously observe the field by means of the auxiliary filamentary focusing light until the tone indicates the flash readiness. A footswitch extinguishes the focusing light and the camera shutter triggers the flash. Fig. 3 shows the equipment arranged for photography.

A diagram of the charging unit is presented in Fig. 4. All of the components used in this unit are listed and are commercially available.

Three cables join the charging unit to the flash lamp housing. These are a three foot length of RG 8/U coaxial cable for the flash current, a length of high tension

Figure 3. The flash unit arranged for photography

PARTS

Switches and Relays

S_1 DPST
S_2 DPST
S_3 Any 110V Relay which has 3000V insulators at contacts
S_4 Mod. 88 Communications Prod's Co., Inc.

Transformers

T_1 Variac Type V2
T_2 Stancor P8151
T_3 Stancor P-134
T_4 Ford Ignition Coil or equivalent
T_5 Stancor P5015
T_6 Stancor PS8416
T_7 Stancor A3250

Resistors

R_1 10K2W Allen Bradley pot
R_2 100K IRC High voltage, type MVJ
R_3 10K IRC High voltage, type MVP
R_4
R_5 10M 2W stabilized carbon
R_6 M W tabilized carbon
R_7
R_8 2M IRC High voltage, type MVJ
R_9
R_{10} 1E W
R_{11} Ω 2W WW pot
R_{12} 50K 2W pot
R_{13} 01E 1W
R_{14} 100K IRC, type MVJ

Condensers

C_1 μf V Electrolytic
C_2 1μf FV
C_3 μf WVDC (
C_4 10μf 2500 WVDC
C_5 2μf 2500 WVDC
C_6 μf 4 V Electrolytic
C_7 50μf 250V Electrolytic
C_8 01μf 400V
C_9 01μf 400V
C_{10} 50μf 50V Electrolytic

Rectifiers

X_1
X_2
X_3
X_4 123 H115 QB2 Federal
X_5 Any 75 mA selenium, Fed A

Miscellaneous

Ballast lamp—117V 40 watt
Pilot lamp—117V 3W
Meter μA
3½ inch PM loud speaker
Vacuum tube—12 AT7
Cabinet 15W x 10 A x 10 Par Metal CA104 or equal
High Current cable—RG8/U coaxial (approx. 3 ft.)
Flash lamp—G.E. FT-230
Automobile dimmer switch

A is a variable transformer which adjusts the input voltage to high voltage transformer C and hence the voltage to which the condenser selected by switch E is charged.

B is a 40 watt 117 volt incandescent lamp which by virtue of its high positive resistance vs. voltage characteristic protects the selenium rectifiers at D from the high initial charging current surge which would occur when the storage capacitor has been discharged through the cable F and through the flash lamp.

G is a voltmeter to indicate the voltage to which the storage capacitor is charged.

H is an adjustable resistor across which a bias voltage is developed which is proportional to the charging rate of the storage capacitor. This bias is used to prevent an audiotone generator from oscillating until the storage capacitor is charged. H may be adjusted so that no tone will be heard until the charge is within a percent or so of that required.

L supplies the energy for the shutter relay J to operate when the camera shutter switch is closed. The contacts of the relay J discharge the energy in condenser K through the primary of the high tension coil M and cause the high voltage pulse generated in the secondary to trigger the flash lamp.

N supplies the energy for the filamentary focusing lamp also in the flash lamp housing. The focusing light is turned on by a foot operated auto headlight dimmer switch just before the flash lamp is to be triggered.

O is a small power supply which supplies the dc power necessary for the audio tone generator Q to function. The tone output P serves the dual purpose of supplying the regenerative signal for vacuum tube Q and of transforming the output of the generator to the low impedance level necessary to drive the small loudspeaker S.

T is a volume control for adjusting the output tone level and U adjusts the output tone frequency.

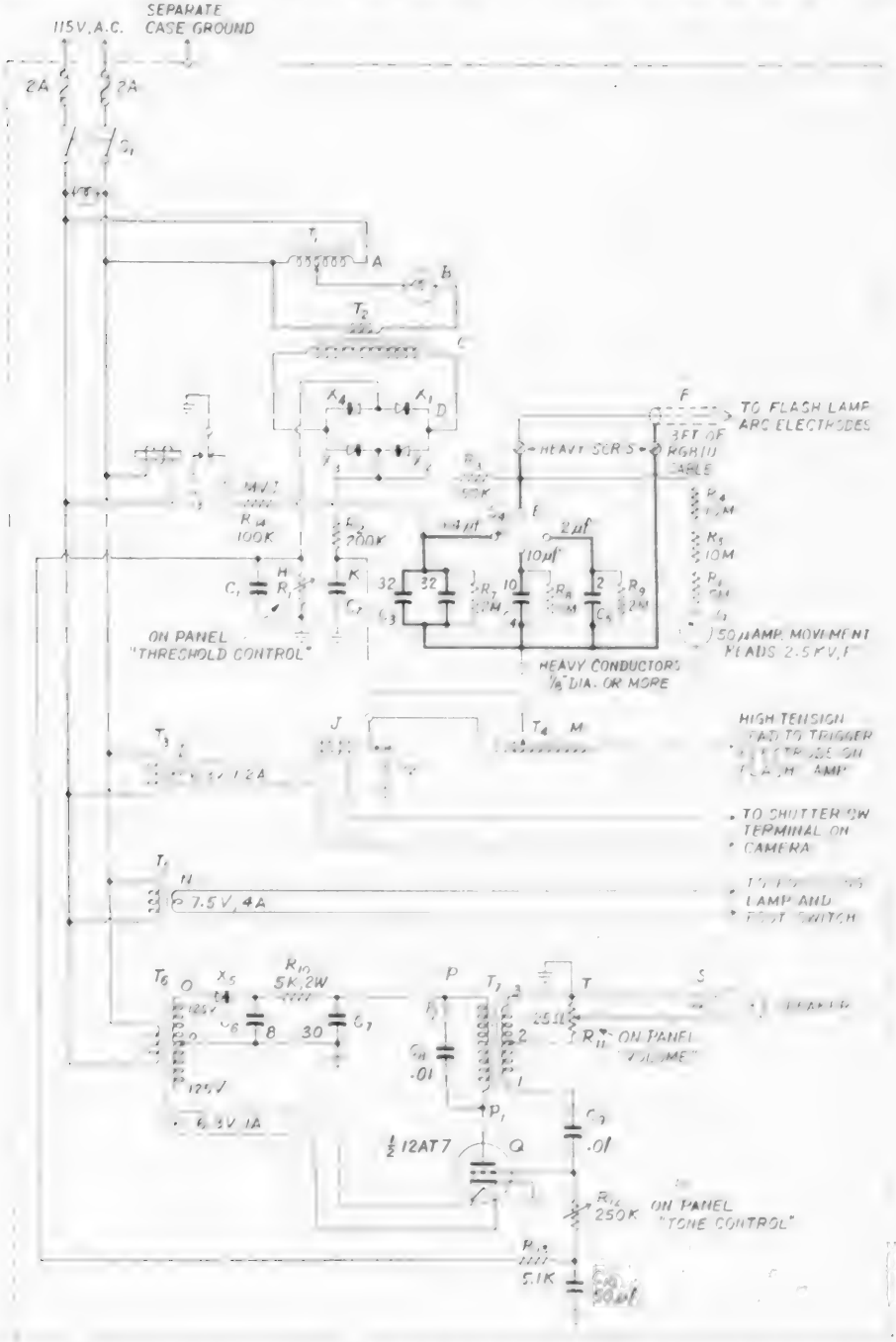

Figure 4. Diagram of charging unit. A list of parts and a brief discussion of the more salient features appear on facing page

ignition wire to conduct the flash triggering pulse, and a twisted pair cable supplying a G.E. 1493 filament lamp. The twisted cable has a series connected branch which allows a foot operated switch to interrupt the current to the focusing lamp.

There is little point in presenting a detailed drawing of the flash lamp unit because anyone making it would probably modify the design to utilize materials at hand.

The flash unit consists of the main frame and mounting bracket, the flash lamp cell, the filamentary focusing lamp cell and lens, and the bull's eye lens and its holder. These components must be mounted adjustably in the frame so that the spark gap is at the principal focus of the bull's eye lens. The focusing light and lens are on the central axis of the bull's eye lens at such a distance that the virtual image of the filament will be located within the spark gap (Fig. 5).

Electrically the unit must be insulated to protect the user from shocks. The flash lamp circuit should have low resistance, low induction, and adequate insulation to prevent breakdown in either the storage or the trigger circuits. Use of adequate spacing, good insulators, and the introduction of a transparent insulating tube (glass or plastic) enclosing the flash lamp and its fine trigger wire will insure the latter point. Low resistance contacts can be achieved by incorporating 1/4 inch shaft locks into the flash lamp mountings and using the lamp housing as the conductor of the current to the grounded side of the lamp.

Figure 6 is a graph indicating the stored energy in each of the available capacitors versus voltage. These energies are directly proportional to the light to be expected and hence may be used to predict the energy required with each change of magnification under fixed conditions.

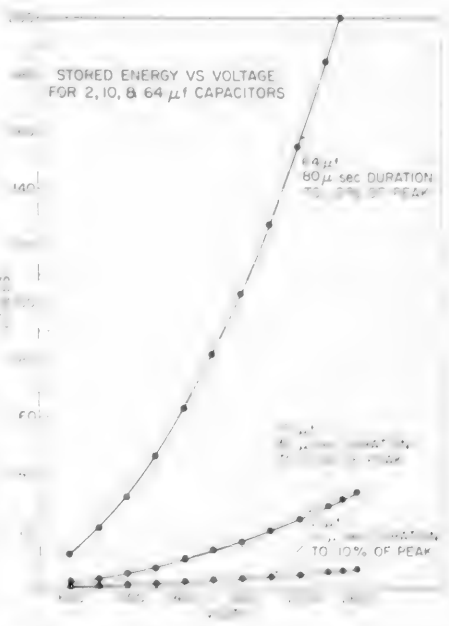

Figure 6. Graph of stored energy versus voltage in each of the available capacitors

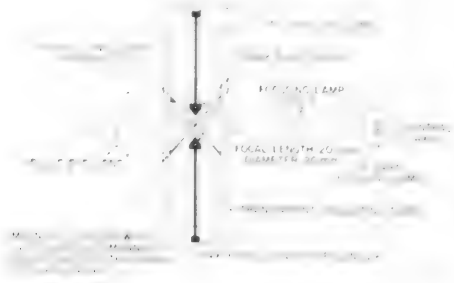

Figure 5. Diagram of flashtube, focusing lamp, and optical components.

With the described electronic flash unit it is possible to make phase contrast and bright field photomicrographs throughout the full range of magnification. Naturally the selection of power output range

and film speed will vary with the optical system used. A careful and complete series of tests is suggested to explore the full possibilities of the unit. Under actual working conditions, using Zeiss phase contrast and bright field optics and a 5500 Å filter, the authors found the high resolution films Adox K.B. 14 and Eastman Panatomic-X excellent for most work. Under special conditions, where a short recharge cycle was desired and a 100X oil immersion phase objective used, Eastman Plus-X film was found to be more than adequate. Processing was carried out using the developers recommended by the manufacturer and developing times were adjusted for the most suitable gamma.

Figures 7, 8, 9 illustrate the range of magnifications possible in phase contrast (i.e., from 80X to 2500X). It is important to note that these are initial magnifications and not the result of photographic enlargement

Figure 7. Trichinella - initial magnification 80X, flash duration 10 micro seconds.

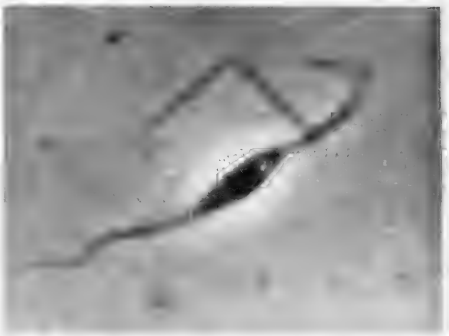

Figure 8. Blood platelet - initial magnification 2,500X, flash duration 80 micro seconds.

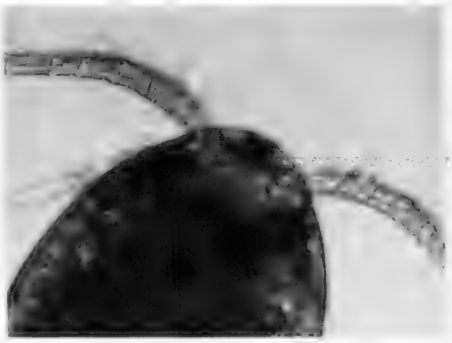

Figure 9. Cyclops initial magnification 125X, flash duration 10 micro seconds.

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A Mobile Apparatus for Cinephotomicrography

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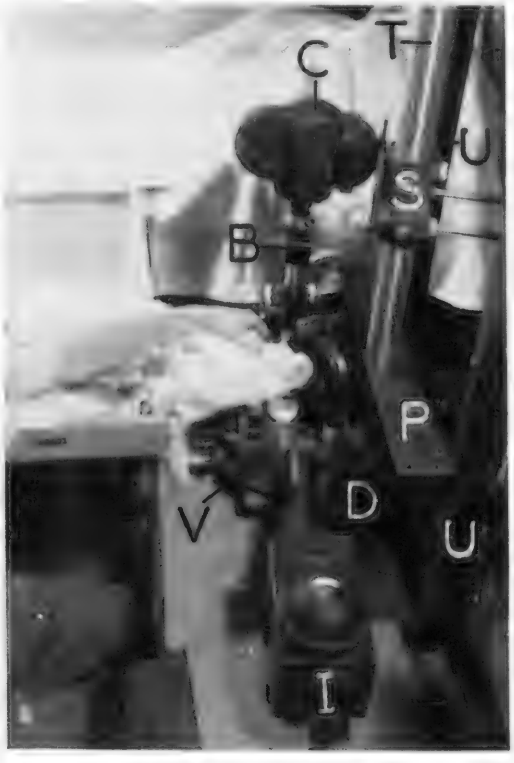
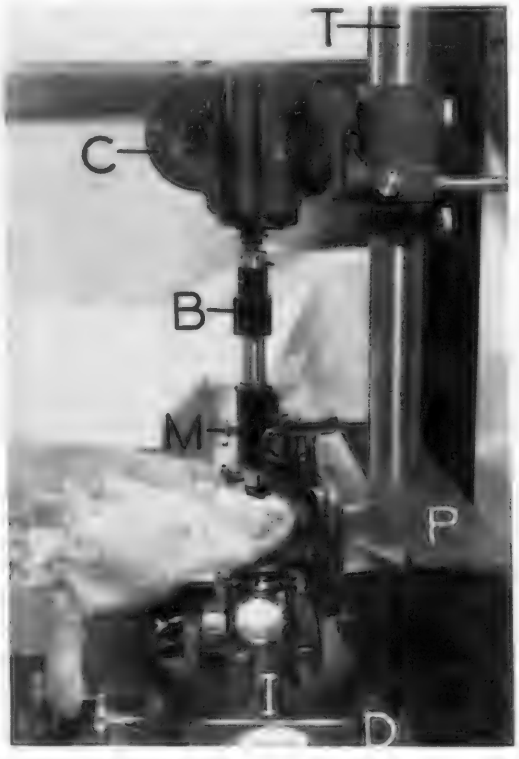
AN arrangement for cinephotomicrography which combines mobility with stability is illustrated in Figures 1 and 2. The entire equipment is mounted on a telephone-type relay rack (R), to which are attached rubber covered wheels. Two horizontal steel L-plates, 1/8" thick, are screwed into the upright (U) bars of the





Figures 1 and 2. B, beam splitter. C, camera. D, desk panel. I, illumination source. M, microscope. P, horizontal steel L-plates. S, camera support. T, 2 inch brass tube. U, upright bars of relay rack. V, milling vise

relay rack and serve to hold the "Ortho-camera simplified vertical column". This consists of a plated brass tube (T), 2 inches diameter, 28 inches long, and a camera support (S) which is adjustable horizontally and vertically on the column, and is rotatable in a horizontal plane through 360 . Set screws are provided for locking the camera support in position, and it is fitted with a standard tripod-socket screw, to which the camera can be attached.

The 2 inch vertical tube is firmly attached to the horizontal plates by passing a 7/16 inch steel rod, threaded at both ends, through the 2 inch tube, and through 2 holes drilled in the horizontal plates. A hexagon nut and lock washer at each end of the rod secures the upright tube to the horizontal plates.

The relay rack is 70½ inches high, and accommodates standard 19 inch width panels. The upright steel channels are ⅛ inch thick, and 3 inches deep, and are drilled throughout their length with threaded holes, at ½ inch and ⅝ inch intervals.

Attached to the rack is a desk panel (D) on which the microscope (M) is set. To provide flexibility in adjusting the position of the microscope, it was mounted on a milling vise (V) the table of which can be rotated 360 , and adjusted in 2 horizontal axes with a dual cross feed.

Focusing of the microscope (M) is done with the aid of a beam splitter (B). The hardware cost, exclusive of optical equipment, and including the milling vise, is approximately $200. It would be desirable to incorporate a rack and pinion on the 2 inch vertical tube, to facilitate final adjustment of the position of the camera lens over the beam splitter.

The entire equipment can be taken down and reassembled.

Details of the equipment (exclusive of microscope and camera and illuminating system) are as follows:

1. Ortho-camera simplified vertical column Cat. No. 37835-600. Silge and Kolex 16th and Carolina Sts., San Francisco 9, Calif.
2. Horizontal steel L-plates are duplicates of that forming the top horizontal cross piece of the relay rack. Relay Rack Cat. No. RR1264. Burl Radio, Inc., 2118 E. 55th St., Cleveland, Ohio.
3. 3 inch SRWS casters. Bond Foundry and Machine Co., Manheim, Pa.
4. Desk panel GT-2216, grey enamel, 22 inches wide, 16 inches deep. Par-metal Products, Long Island City, New York.
5. Craftsman milling vise. Cat. No. 99D-02496K. Sears Roebuck & Co., 4640 Roosevelt Blvd. Philadelphia 32, Pa.
6. Beam splitter (Gahleo). Opplem Co., 35 Uhland St. E. Rutherford, N.J.

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A Method for Making Quality Line Lantern Slides Economically*

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TO provide efficient lantern slide service to the research and teaching staffs of our medical school and of two affiliated teaching hospitals, it was necessary to devise a system more satisfactory than that formerly used. Our aim was to have every department produce a quality product but to simplify procedures in order to conserve time and to minimize expense. This aim has been accomplished by making a better choice of materials and by altering the processing equipment. The new system, which adequately handles the usual heavy volume of slides, the added number at peak periods, and the many emergency orders, is based on the following features:

1. The use of lithographic negative materials for line work.
2. The use of film rather than plates for the positive projected material.
3. The making of minor alterations in the processing equipment to permit the use of the most convenient film size.

The Use of Lithographic Negative Materials for the Copying of Line Originals

Lithographic film provides negatives of good contrast even from poor originals. Excellent reproductions can be made from ink drawings and line illustrations taken from text-book copy, reprints, etc. Legible copies can be obtained from pencil and typewritten material. This film is available in panchromatic and orthochromatic emulsions.

The orthochromatic and color blind types of film are easily handled, cut, loaded and processed in a safe, well lighted darkroom. The former may be used in the illumination of a series 1A safelight which provides good visibility for all phases of the procedure. The latter may be processed in bright yellow light. Since development may be carried out under inspection for the full length of time, good development control is possible even when special problems or conditions are encountered. Since use of time and temperature method is not necessary, temperature control equipment is not needed. The fixing, washing and drying times are much shorter than usual because of the thinner emulsion and backing of this film. However, lithographic film may be safely washed and dried at higher temperatures because of its harder emulsion and it is more resistant to abrasion and finger markings. When necessary or convenient, it may be handled by hand rather than in hangers, without some of the difficulties usually encountered with films whose images are suspended in softer emulsions.

*Presented at the 24th Annual Meeting, Atlantic City, 1956.

Possibly the most favorable characteristic of lithographic film is its low cost. Lithographic film in the 3¼ x 4¼ in. size costs approximately $.045 per sheet, as compared to $.09 per sheet for the process type films. Because of its primary use in the printing industry, lithographic film is seldom catalogued in sizes under 5 x 7 inches. However, lots of $50.00 or more will be cut to specifications without additional charge. However, one single 8½ x 11 in. sheet. Thus, exposing, developing, rinsing, fixing, washing and drying of many films are accomplished in little more time than is required for a single film. Since the positive film is readily aligned within a mask when the slide is bound, the difficulty of printing a perfectly aligned image on each positive is obviated.

The use of film reduces the seriousness of breakage. In the event of breakage,

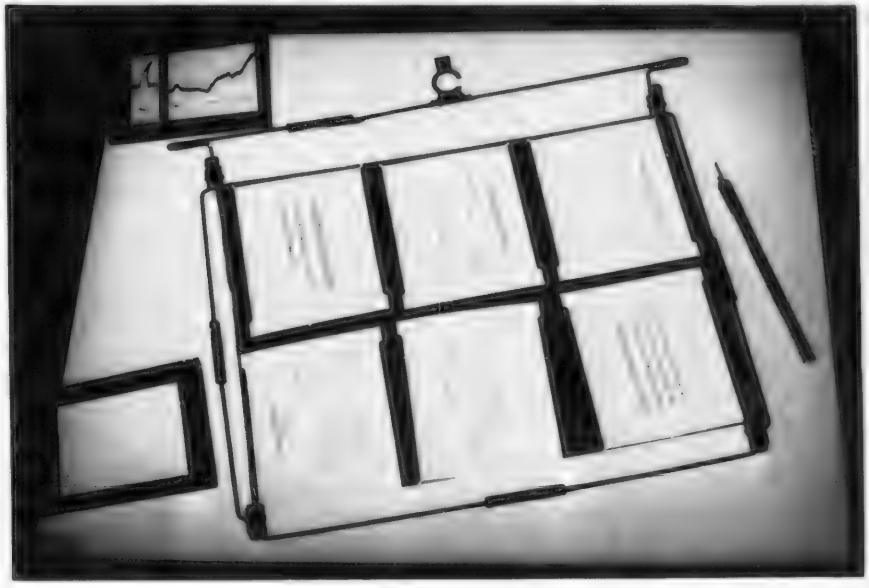


Figure 1. Modified film hanger.

manufacturer has recently listed 3¼ x 4¼ inches as a stock size.

The Use of Film Rather Than Plates for the Positive Projected Material

The use of film saves time and trouble in the making of positives for projection in the case of either line or tone photographs. Usually six or more negatives can be printed simultaneously on a usually only rebinding rather than reprinting is necessary. During five years of using film for the bound positive only about three per cent of the slides returned for repair have had the film damaged beyond use. When the lecturer is many miles from his photographic service, it is certainly easier to have a slide rebound than to have it reprinted.

Again, cost becomes an important fa-

tor in the selection of positive material. On the basis of combining six negatives for printing simultaneously on one sheet of 8½ x 11 in. stock, the cost for sensitized material is approximately $.045 per slide, compared to $.166 each when glass plates are used.

Adoption of Minor Alterations in the Processing Equipment to Permit Use of the Most Convenient Film Size

The size of *Eastman Type* 3, 8 x 10 in. hangers is conveniently increased to 8½ x 11 inches by soldering stainless steel tubing as extenders. (Figure 1.) By making this simple alteration in the developing hangers, 8½ x 11 in. film is employed advantageously. This size affords a more comfortable working space than does 8 x 10 in. film, unless the latter is cut into six pieces. However, the cut film must be handled individually and frequently falls out of 3¼ x 4¼ in. film hangers during processing or drying. In contrast, 8½ x 11 in. film accommodates six full unmasked standard 3¼ x 4¼ in. positives. If positives are to be masked, 4¼ x 5¼ in. negatives can be used, and twelve can be printed at once. In addition, any combination of negative sizes can be printed together.

Procedure

The 3¼ x 4¼ in. negative provides a good size for slides made by contact which represent a major portion of our orders. From negatives of this size excellent 8 x 10 in. prints are easily made. A 3¼ x 4¼ in. negative is sufficiently large that it can be spotted, its correction patches painted out, new sections taped in, and possibly border lines etched. These features are particularly valuable when the resulting slides are to be 35 mm. in size, as the patches, etc. are not obvious in the final product. This, of course, is not possible with such ease when microfilm is used as the negative material. For 2 x 2 in. slides, eighteen or twenty reduced slides can be made at one time from transilluminated negatives with an 8 x 10 in. process camera. With a 35 mm. camera 2 x 2 in. slides can also be made by the same method.

Negatives are made on a vertical stand with the copy under glass when necessary. Illumination is furnished by four 500-watt 3,200 K frosted lamps in reflectors. These lamps were chosen because of their high intensity, long life, and correct color temperature—necessary when color copies are to be made. Job numbers are exposed into each negative to facilitate filing. These appear on the positives, and separation of jobs at the time of binding is easily accomplished.

Processing is carried out in either a paraformaldehyde developer (similar to D-85) or a caustic soda type developer (D-8). The former provides maximum contrast. The latter, however, is advisable at certain times, especially when an original is made of both negative and positive copy. Better rendition of all parts is possible with a single "all-over" exposure, despite the great difference in reflective quality in the two portions. Rinsing, fixing, and washing are done in the usual way. After a few seconds treatment in a wetting agent, films are dried in a forced, warm air drying cabinet. If the slides are to be negative in tone they are now mounted plain, colored with cellophane, or tinted and bound.

Film positives are printed in a printing frame on 8½ x 11 in. lithographic film. Better contact is obtained this way than with a contact printer. Use of the printing frame permits any combination of shapes and sizes to be arranged and printed on one large sheet of film. Exposure regulated by an automatic timer

is made by a ceiling lamp suspended over the printing table. Line positives are developed in either D-85 or D-8. Development, rinsing, and fixation are done in trays. The films are then transferred to the developing hangers for washing and drying. Drying is done in the same cabinet used for the drying of negatives.

Although this paper is concerned chiefly with line work, many of the features described are also applicable to the production of tone copy. If tone negatives are sufficiently consistent, they may also be printed in multiples on fine grain positive film. This emulsion is similar in contrast to that of medium contrast lantern slide plates. When negatives differ greatly in density and contrast, they should be handled individually or grouped by contrasts to afford proper exposures and development. Since 8½ x 11 in. positive tone film is not available, 8 x 10 in. film is used. Tone positives are developed in one of four developers depending upon the contrast desired. In order of descending contrast they are *Kodak D-8, D-11, Dektol,* and the soft working developer, Ansco 120. Miniature lantern slides may be made in a similar manner by photographing transilluminated negatives with a 35 mm. camera. Two different contrasts of positive stock are available.

The cost in setting up for the procedures mentioned was negligible, the cost of materials was lower and time has proven that a very good quality result is easily obtained.

The 27th Annual Meeting of the

BIOLOGICAL PHOTOGRAPHIC ASSOCIATION

will be held in

Rochester, Minnesota, August 27-30, 1957.

Your host will be—The Upper Midwest Chapter.

Combine conference and vacation in "Minnesota — Land of 10,000 Lakes" . . . learn and relax at the same time.

S. J. McCOMB, FBPA., *Chairman*
Photographic Section
MAYO CLINIC, Rochester, Minnesota

VERLIN Y. YAMAMOTO, FBPA
L. A. JULIN, FBPA
Committee Members

Your Association

A section of the Journal devoted to official announcements, chapter events, and other matters of historical significance to the Association.

The President's Page

H. Lou Gibson

The progress on a possible certification measure to be advanced by BPA has been published in connection with the report on the April 1956 Meeting of the Board of Governors. Since that time Graham Eddy has initiated a codification of the aims of the Standards Committee. The proposals will be prepared for our Journal by William Campbell, the new chairman. The conclusions arrived at are essentially that certification is too complex a subject for total action at this time. Therefore, the structure of the items for certification will be established. The mechanism will then be ready for the time when a move toward proposing an independent Certification Body may seem propitious to the BPA. Such details will also be valuable for presenting to others who may ask the BPA for its ideas and plans on certification.

As pointed out before, an educational program must be firmly established before any steps toward actual certification can be initiated. When the details of the levels of education, the required subjects, and the experience background are set forth in a certification desideratum, it will be more practical to further and encourage the correct educational facilities. And when such facilities are available, it will be easier for any group desiring certification measures to find a basis for implementing them. Though exams can test proficiency, evidence of a good background is a reassuring bolster for a well-passed exam.

The BPA Journal is the most tangible "benefit" to almost 1500 readers belonging to our Association. We have published 24 continuous volumes of unique technology and application. Its regularity has been outstanding for a Journal of its kind—a fact that often is not appreciated until circumstances interfere. From our editors, it calls for a great deal of work and dedication as well as special qualifications. We must therefore be highly appreciative of the many years of steady effort by Leo Massopust and the exemplary volumes prepared by Lloyd Varden. But we must not overlook the fact that our editors have exacting personal duties too. Therefore, we should all do our utmost to find, encourage, and adequately prepare material for the interchange of ideas afforded by the Journal.

The formation of the new Suggestions Committee, chairmaned by Howard Tribe, 2117 Wilson Avenue, Salt Lake City 5, Utah, makes it desirable for each Member to examine the many other, less tangible, benefits of belonging to the BPA. It will then be easier to suggest improvement in old services and accomplishments and to gain definite ideas about practical new ones.

The very fact that there is an organization like ours, with its prestige in a special field, is an advantage to all bio-

logical photographers. The interchange of ideas on techniques, uses, and equipment, that is made possible through our Annual and Chapter Meetings and our Journal, makes better photographers out of all our Members. This raises the quality of production in the field. The effects get to Members who attend the Annual Meetings first; yet it eventually perfuses through the entire Membership. This benefit is paid for by those who attend, but it is only possible because of the strength of the group. Our Meetings are designed to break even, but they usually make a small profit for our treasury.

The users of biological photography are also better served by our progress. They themselves can proceed in the confidence coming from the existence of definite standards. This does not constitute certification for our Members, but it does hold the benefits of offering some assurance. Of course, formal proposals on education and other standards will also be to the good of the field.

Those who consider making or utilizing biological photographs are helped by having a source of information about techniques and personnel. They often write BPA. The directors of photographic departments thereby have a better idea of the skills, responsibilities, and equipment involved. Unqualified persons are thus deterred from overextending their capabilities.

The BPA can also enable its members to work out ethical solutions to common problems. For example, certain hospitals have limited educational programs, which nevertheless deserve good photography. When resources are small and incapable of supporting an extensive photographic department the photographer often receives the concession to do outside work. The basis on which the abuse of such a system can be avoided can be worked out by studying the procedures of those successfully functioning in this manner. Means for financing the department itself also can be found by comparing notes.

There are times when work may periodically slacken a little in some departments. The progressive member will find ways to increase the utilization of photography by doing unrequisitioned photography to stimulate further applications. For instance, photographic albums on specific topics can be made up for the library. Or a group of photographs on home care—illustrated with each individual patient—can be prepared for the family. Thus, the physician will have more confidence that his instructions will be carried out. Ideas like these originate from and can be exchanged by BPA Members. They lead to more substantial utilization of photography and more important departments. Photographic research problems, such as the mapping of anatomical or infrared variations, are also valuable in such periods. Needless to say, work on a paper for our Journal would be beneficial all around.

There are many other channels through which the BPA can bring benefits to its members. Our Association is concerned with public relations and works toward letting both the specific professions and the general public know of its aims and activities. It is also establishing means for closer liaison with the former. It keeps institutional directors advised of its Annual Meetings and other programs. The BPA circulates top-quality [illegible] exhibits and print exhibitions for professional groups and informed laymen. Verlin Yamamoto, Medical Illustration Laboratory, Veterans Administration Center, Des Moines 9, Iowa, directs our exhibits. Lawrence Reynolds, Medical Photography, Pathology Labora-

tories, Rochester General Hospital, Rochester 8, New York, will be routing the prints for the 1956-57 term.

Through the Annual Exhibition of prints, slides, and motion pictures, which supplies much of our material for distribution, the photographic proficiency of the participants is stimulated. As a further encouragement in improving the prime purpose of many of the photographs shown at the Annual Exhibition, we have inaugurated the BPA Medical Education Award. It carries five prizes of $[illegible] each and is given to those who have advanced the aims of the BPA. And again the quality of our papers at the Meetings and in the Journal is upheld by similar recognition. Fellowships provide standards of achievement that serve as anchor levels to keep up the appreciation of biological photography for the benefit of all. These accomplishments are brought to the attention of the respective department heads.

There are now 21 committees of energetic members donating their busy personal time and energy to bringing tangible and intangible benefits to the membership of BPA. Sometimes progress is slow, as is natural with a widely scattered non-profit organization. Nevertheless, in what the committee men and women do and how the membership helps lies the benefits of belonging to BPA. Our members often *work* in the dark, but they would *be* in the dark if it weren't for the BPA Number 21 Safelight!

NEW B.P.A. MEMBERS

(October-December, 1955)

Dr. John W. Adams, Saskatoon, Canada
Clarence D. Best, Pittsburgh, Pa.
Dr. Clarence A. Bradford, Los Angeles, Calif
Dwin R. Craig, Washington, D.C
Leslie E. Daugherty, M.D., Cumberland, Md
Robert E. Ennis, San Francisco, Calif.
Maurice R. Foster, San Gabriel, Calif
Dr. A. A. Golden, Wilmington, Del
Don M. Harding, Pasadena, Calif
Howard W. Harper, Junction City, Kan.
William F. Hildebrand, Indianapolis, Ind.
John F. Huber, M.D., Philadelphia, Pa
Ralph L. Isenburg, Baltimore, Md.
Arthur F. Jacques, Providence, R.I.
James C. Kudulis, Menomonee Falls, Wis
Zalkin Mandelstam, Chicago, Ill
Gilford R. Millard, Columbus, Ohio
Maury Mills, Los Angeles, Calif.
Anthony G. Minoudis, Los Angeles, Calif
J. M. Dubois de Montreynaud, M.D., Reims, France
Paul K. Moore, Miami, Fla
Paul Perles, Chicago, Ill
J. Paul Ralston, Jr., Moorhead, Minn
Morton S. Russin, Greenwich, Conn.
Milton Schonberger, Leonia, N.J
Jesse Schulman, Lakewood, N.J
Thomas A. Stebbins, Baltimore, Md
Warren A. Taylor, M.D., Thomasville, Ga.
Pendleton Tompkins, M.D., San Francisco, Calif
Martha L. Wessner, Evansville, Ind

FIRST FIVE-DAY ANNUAL MEETING IN BPA HISTORY TO BE HELD IN AUGUST IN ROCHESTER, N. Y.

The 26th Annual Meeting of the Biological Photographic Association, Inc., the first five day meeting in the group's history, will be held August 27-31 in the Powers Hotel, Rochester, N. Y.

The Rochester, N. Y., chapter plans several new features expected to make this year's Meeting one of the most outstanding in recent BPA history.

The Biological Photographic Association, celebrating this year a quarter century of professional service to universities, medical schools, and hospitals, is a national organization of scientific photographers concerned with the techniques and applications to photography in medicine, zoology, botany and other related fields.

The Rochester Meeting, the fourth to be

held in the world's photographic center, will bring together several hundred medical and other biological photographers and scientists from various sections of the country. A number of important papers will be presented dealing with advances in biological photography. There will be a special award for the best paper presented at the Meeting.

John J. Beiter, FBPA, general chairman, has announced that a special day-long workshop will be held Monday, August 27, on recent developments in materials and processes for color photography. Lectures and demonstrations by recognized experts will be tailored to the limitations of the average medical or biological laboratory.

Regular Meeting sessions will get underway Tuesday, August 28, with a meeting held in the George Eastman House of Photography, the independent photographic museum that was the former home of the famed film and camera manufacturer. A special movie program is on the agenda following this business meeting, which is open to wives of BPA members.

This year's Meeting will also feature an exhibit of books written and/or illustrated by BPA members. This exhibit will serve to emphasize the important contribution made by BPA members to scientific literature.

Details surrounding the exhibition of photographs, slides and motion pictures on biological subjects are receiving special attention this year from an enlarged committee. Plans call for an attractively arranged exhibit in the Powers Hotel of all accepted prints. This year's exhibition committee has been divided into the print committee, and the motion picture and transparency committee. The latter group will handle the showing of accepted entries in this category during Meeting hours and in evening periods. The exhibition is open to BPA members only.

Prior to the Meeting in August, all BPA members will receive by mail a copy of the compendium, another ambitious undertaking this year by the Rochester chapter. The compendium will include the complete program of events and speakers for the Meeting, as well as several award-winning photos in color and black-and-white together with the names of those submitting accepted entries in the photographic exhibition.

The annual awards banquet of the 26th Annual Meeting will be held Thursday evening, August 30, in the Powers Hotel. In addition, a noon luncheon will be held Wednesday, August 29. There will be speakers for both occasions.

Tours have been scheduled through the 550-acre Kodak Park Works of the Eastman Kodak Company, and the Bausch & Lomb Optical Company. Alternate tours may be made through the medical photographic departments of the University of Rochester Medical School and the Rochester General Hospital.

Nearby the Meeting rooms in the Powers Hotel, commercial exhibitors will show the latest in equipment for work in biological photography.

There will be a special program for the ladies, too. Plans are being made to have wives of BPA'ers attend a special ladies' luncheon and take a "behind-the-scenes" tour of a large Rochester department store. They may also take the scheduled BPA tours.

Other members of the Rochester chapter serving as committee chairmen are: Harris B. Tuttle, FBPA, advertisements; Arden J. Rootes, commercial exhibits; William Shoemaker, judging; Mrs. Katherine Jensen, local arrangements; John A. Gaughan, motion picture and transparency exhibit; Frank J. Fernandez, print exhibit and publications; Charles G. Brownell, publicity, and John V. Butterfield, FBPA, scientific program.

Secretary and treasurer, respectively, of the 26th Annual Meeting are Martha M. Brumings and Merwyn Orser.

New Products

ARKAY PROCESSING EQUIPMENT FOR ELECTRON MICROSCOPE LABORATORIES

The Arkay Corporation, 1570 South First Street, Milwaukee 4, Wisconsin, announce the availability of their new EM line of photographic processing hangers and tanks. The EM line was designed, in cooperation with the Electron Microscopy Liaison Committee of the Biological Photographic Association, to meet the photographic processing requirements of electron microscope laboratories.

The various components of the EM line will accommodate the plate and cut film sizes used in all commercial electron microscopes currently available in the United States. EM plate and film processing hangers are available in the following standard sizes: 2" x 10", 3¼" [illegible] up to six of these hangers are accommodated at one time in insert tanks encased by a combination water jacket and rinse tank, which provides precise control of processing solution temperatures. Maximum protection against accidental breakage [illegible] the films or plates remain in their individual hangers throughout processing. Greater uniformity of development and finer grain structure result from the fact that processing solutions and rinse water are at the same temperature.

The standard insert tanks require only one half gallon of processing solution and are equipped with floating lids. Processing solutions may be stored in the tanks and are ready at all times for immediate use. This [illegible] "Light" lid is available for the processing unit [illegible] lights must be turned on for some reason.

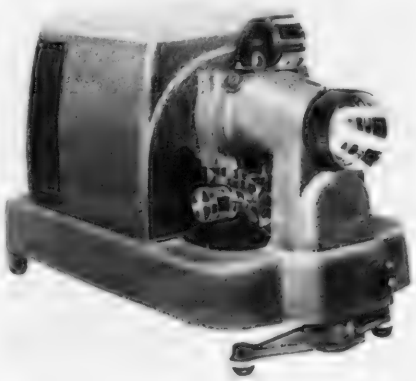
[illegible] accommodates up to 24 of the special processing hangers (and all standard sizes up to 5" x [illegible] EM line insert tanks to accommodate all standard and special sizes [illegible] are available to fit the special EM line water jacket.

In addition to the cut films and plates for electron microscopes, the EM line processing unit components will accommodate the special sizes used by many spectrographic and electron diffraction cameras. Special size film-plate processing hangers, not exceeding 7" x 10", are available on special order. All components of the EM line are constructed of highly polished type 316 stainless steel for durability and ease of cleaning. The tanks feature reinforced corners, double lock seams with outside soldering, and self-drain hose.

For further information and prices contact the manufacturer, specifying cut film and plate sizes to be used.

VIEWLEX

Viewlex [illegible] manufacturer of [illegible] tion equipment, now announces a new, [illegible] Projector for 2" x 2" slides. The MODEL V-[illegible] is the most powerful instrument which projects brilliant images to large audiences with a clarity never before achieved in the audio visual field. The Model V-1000.C is the only [illegible] approved by [illegible] Specifications) or on the Military Qualified Products list. For use in civilian life, it drops its O.D. garb and steps out in sleek, two-tone grey.



Many outstanding features in the Model V-1000.C contribute to its precision perfect performance in the educational field and industry.

In spite of its tremendous illumination, this 1000 watt projector is amazingly cool in operation. [illegible] watt models. A new system of pressurized air [illegible] plane and then the condensing lenses, and finally over the lamp. Heat does not accumulate [illegible] SIDE louvres.

The V-1000 handles [illegible] frame filmstrips for vertical and horizontal projection, and 2 x 2 and bantam slides. A [illegible] one turn for each whole frame with either single or double frame filmstrip. Filmstrip can be threaded in a split second. The take-up assembly is built on to the filmstrip attachment [illegible] tive framing. Annoying light-leak has been eliminated completely, because, due to the design of the pressurized cooling system, the [illegible] and sealed. The projector is equipped for individual front leg level-control.

The Viewlex Model V-1000C is equipped with 5" F3.5 Professional lens. A 5" F/2.8 [illegible]

Viewlex has priced this new 1000 watt com[illegible] at $219.50. A [illegible] with [illegible] The [illegible] with [illegible] ing unit is priced at $169.50.

Interchangeable focal length lenses of 3", 4", 5" and 7" model, [illegible] astigmat, are available at $49.50, $59.50 and $79.50. A Deluxe carrying case is $19.50. For information, write: Viewlex, Inc., 35-01 Queens Boulevard, Long Island City 1, N.Y.

NEW ARKAY PROCESSING HANGER

A 3¼" x 4" Developing Hanger, of special interest to Visual Aid departments and users of Lantern Slides, is announced by the Arkay [illegible] been too readily available on the market.

Made of type 316 Stainless Steel this hanger has perforated, tilted channels for quick thor[illegible] tion and the strong spring clip will hold the slide or film within the channels.

The Hanger [illegible]

ASCORLIGHTS A-205 AND A-206

The American Speedlight Corporation announces and introduces two new Electronic Flash Units at the 10th Annual National Photographic Show being held in the New York [illegible]

The Models A-205 and A-206 [illegible] add to the long-established, dependable

A-205

featherweight and economical 200 Series a "New Molded Light Head (Model L-210)" made [illegible]

Use with AC, Dry Battery or Nickel Cadmium Battery

Slave tube operation [illegible] protects the shutter

Special internal surfacing of the reflector assures an even distribution of light for [illegible]

A-206

Coiled Cord on light unit
Fast recharge time - 3 seconds
[illegible] station 1/2000
Guide Numbers: Tri-X 110
ASA 32 Color 40

600MM AND 800MM LONG-RANGE TELON LENSES

The long-range TV Telon lenses, products of the Tewe factory in Berlin, Germany, are [illegible] in the U.S.A. in 600 and 800mm focal lengths (24 and 32 inches) and in mounts to fit [illegible] Exaktiflex 35mm cameras. The Telons are used [illegible] undesirable or impossible to bring the camera close to the subject.

[illegible] system of elements, provides a lens that is relatively brilliant, lightweight and easy to handle. The brilliance of the system is further increased by the application of anti-reflec- [illegible]

The 600mm Telon has a maximum aperture of f/6.3 and 3° angle of view. It stops down to f/32, focuses down to 23 feet and extends [illegible] inches from the camera when focused at infinity (30½ inches with sunshade). Weight [illegible] pounds. Price: $565.

The 800mm Telon has a maximum aperture of f/6.3 and 3° angle of view. It stops down to f/44, focuses down to 40 feet and extends [illegible] inches from the camera when focused at [illegible] Weight [illegible] pounds. Price: $750.

A detachable sunshade is supplied with both lenses at no extra charge. A rotating base with tripod sockets, so the lens can be used for vertical and horizontal-format photos, is included. The metal lens mount has a black [illegible] in both feet and meter.

Telons in mounts to fit the Exakta 35mm cameras are available from Exakta Camera Company, 705 Bronx River Road, Bronxville 8, N.Y. [illegible]

NEW 16MM PROCESSING MACHINE

An all-purpose automatic developing machine, which fills the need for reversal processing as well, has recently been announced by S.O.S. Cinema Supply Corp. Known as Bridgamatic Jr., Type RA, this 1956 innovation takes the new pre-hardened emulsions, including Eastman Tri-X reversal. Bridgamatic RA features a variable speed control allowing changes in developing time from 1.5 to 12 minutes and will process at the rate of 1200 feet per hour at normal temperature. A light-tight section encloses the first four tanks. Cantilever construction permits easy cleaning and maintenance. Standard equipment includes a feed-in elevator, 1200 foot daylight magazine and other Bridgamatic features, such as stainless steel tanks, air squeegee, air agitation for bleach tank, self-contained plumbing, etc. A time payment plan is being offered with trade-ins of professional equipment accepted as down payment. Information on the 14 varieties of Bridgamatic Developing Machines is available from S.O.S. at 602 W. 52nd St., NYC. Prices start from $1090.

NEW 16MM PROFESSIONAL COLOR FILM

A low cost 16mm color film for commercial and television motion pictures has recently been introduced by McGregor Production Company. The film features softer color rendition.

McGregor Professional color film is planned to fill the requirements of motion picture producers for an inexpensive reversal color film

suitable both for original projection and duplicating multiple release prints. The new color film is screenless and practically grainless. McGregor manufactures film of the subtractive type with dyes added during selective reversal processing. Film is coated on a triacetate safety base and is made in both daylight and tungsten type emulsions. Exposure indices are 10 for Daylight and 15 for tungsten. Tungsten film is balanced for 3400K. Emulsions are standardized so color correction filters are not required for ordinary use. Regular color and conversion filters can be used.

Professional film is available in 100-ft. daylight loading spools with perforations for silent or single system sound cameras. A color duplicating film for release prints is available through many laboratories. Price of the 16mm professional type film is $6.90 for 100-ft. rolls, including Federal Excise Tax and processing at the McGregor Laboratory. Film is available from the Professional Sales Department, McGregor Products Company, 16 State Street, Rochester 14, New York. Literature is offered free to commercial producers and professional photographers.

LEITZ' FIRST NEW MICRO-MANIPULATOR SINCE WAR IS INTRODUCED

A new micro-manipulator with single one-hand mechanical control so precise, according to the announcement, that micro-knives, needles and pipettes can be kept within a 0.136mm field of view during operations on living cells and other specimens, has been developed for use in the biological sciences and technology by E. Leitz, Inc. Literature is avilable from the firm, located at 468 Fourth Ave., N.Y.C.

Achievement of mechanical control also is said to eliminate the effects of climatic conditions common in pneumatically controlled instruments.

STEELEX STAINLESS STEEL PAILS AND MEASURING GRADUATES

Recent developments in metal-working methods have resulted in a new line of seamless stainless steel utensils suited for photographic use. Such items as pails and measures are now being flow-turned out of solid sheets of 18-8 type 302 stainless. This new process, which is akin to spinning, makes possible items which are stronger in tensile strength, more uniform, more accurate in calibration, and nicer in appearance. With this modern technique, pails are made which have a minimum of 13 gauge steel at the bottom and upper rim so that they resist greater impact and provide much longer service.

The measuring graduates range in size from 5-oz. to 32-oz. and are calibrated with raised letters which are easier to read and are permanent. STEELEX stainless utensils will be supplied through photographic dealers and distributed to photographic dealers through Franklin M. Morgan, Inc., 19 Murray Street, New York 7, New York.

KERN SWISS PRISMATIC BINOCULAR MICROSCOPE

This is a low power precision instrument for scientific and industrial use, according to Karl Heitz, Inc., distributors. Precision-ground Kern lenses and prisms render a reinverted, stereoscopic image which eliminates eyestrain. An extremely wide field of view and ample working space between microscope and object allow easy, unhampered work. Magnification may be varied from 7 to 100x, with 6 pairs of lenses, 2 lens turrets and 2 pairs of eyepieces available. A choice of 6 different stands and 4 light systems meets any individual requirement. Reticles in fractions of millimeters or inches are available on request. Prices: Model PL 3 with vertical eyepieces, objectives I, stand N, $168.40. Model PL 4 with inclined (30°) eyepieces, objectives I, stand N, $238.40. For more information write to: Karl Heitz, Inc., 480 Lexington Avenue, New York 17, N.Y.

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Members may propose for Fellowship in the BPA other members whom they consider worthy of recognition. To be eligible for Fellowship a candidate must have been a member of the Association for five consecutive years and must possess one or more of the following qualifications:

Superior craftsmanship in still or motion picture photography of biological subjects.

Ability in photographic research in new methods or materials.

(These require submission of evidence.)

Meritorious contributions to biological photography overall through sustained organizational work.

Two sponsors are required. The sponsors should be well acquainted with the candidate's work and ready to furnish the Board with details of his experience and achievements. Those who wish to sponsor a member whom they believe to be eligible should request a Fellowship Application form from the Secretary of the Fellowship Committee: Mrs. Maria Ikenberg, University of Illinois, 904 W. Adams Street, Chicago 7, Illinois.

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